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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/579,734

**Applicant(s)**

BANDO ET AL.

**Examiner**

SARAH PIHONAK

**Art Unit**

1617

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 April 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 and 3 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SE/IB)  
Paper No(s)/Mail Date 5/18/06, 6/3/08, 10/30/08
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

### **DETAILED ACTION**

This application is a 371 (national stage application) of PCT/JP2004/018569, which was filed on 12/13/04. This application also claims foreign priority to Application No. 2003-419362, filed on 12/17/03 in Japan.

#### ***Response to Arguments***

- 1) Applicant's arguments, filed 4/7/09, with respect to the rejection(s) of claim(s) 1-3 under 102(b) have been fully considered and are not found persuasive. The rejection under 102(b) was based upon the initial set of claims; however, the arguments presented regarding the rejection are based upon the amended set of claims. The amended claims were presented along with Applicant's arguments in the reply filed on 4/7/09. The initial set of claims cited a process for synthesizing 2-acylthiophene by reacting an acid anhydride or acid halide with a substituted or unsubstituted thiophene, in the absence of solvent, at a temperature less than 75 °C, with a solid acid catalyst. The US 6,274,741 patent discloses a process for producing 2-acylthiophene, with acid anhydrides, without solvents, between a temperature range of 0-130 °C, with metal exchanged clays as catalysts (column 2, lines 32-59, column 3, lines 54-57). The weight ratio of metal exchanged clay catalyst to thiophene compound taught by the US '741 patent was 0.12 (0.5 g. catalyst to 50 mmol thiophene, column 5, example 6), which is within the range taught by instant claim 3. As metal exchanged clays are solid acid catalysts, the rejection of claims 1-3 under 102(b) in the office action dated 1/7/09 was therefore proper. In the reply filed on 4/7/09, the Applicant's submitted an amended set of

claims which replaced the solid acid catalyst with cationic exchange resin. The US '741 patent does not disclose the use of cationic exchange resins. Therefore, the rejection of claims 1-3 under 102(b) over the US '741 patent is withdrawn due to the claims amendments. However, upon further consideration, a new ground(s) of rejection is made in view of the amendments to claims 1 and 3 in the response filed on 4/7/09. In this response, claim 2 was cancelled by the Applicant.

- 2) Applicant's arguments, filed on 4/7/09, with respect to the rejection(s) of claim(s) 1-2 under 103(a) have been fully considered and are not found persuasive. The arguments presented by the Applicant address the amended set of claims, and not the initial set of claims discussed in the office action dated 1/7/09. The WO 01/32593 publication discloses a method of acylating an aromatic heterocyclic compound, which may be substituted, in the absence of solvent, with zeolite as a catalyst (claims 2, 12, 17). Claim 16 of the WO '593 publication discloses that the compound to be acylated includes thiophene. The acylating agent disclosed are halides of carboxylic acids and anhydrides of carboxylic acids (claim 7). While the WO '593 publication does not explicitly teach the temperature range for the reaction, examples are provided in which the reactions were conducted at 70 °C, 100 °C, and 120 °C (p. 10, first paragraph). While the WO '593 publication does not explicitly cite that thiophene is acylated in the 2-position, the US 2,458,519 patent teaches that thiophene is predominantly acylated in the 2-position (p. 2, column 4, line 8). The initial claims 1-2 disclosed a process of producing 2-acylthiophene with a solid acid catalyst, at a temperature less than 75 °C. Zeolites are solid acid catalysts.

Therefore, the 103(a) rejection of claims 1-2 in the office action dated 1/7/09 was proper. However, in the reply filed on 4/7/09, claim 2 was cancelled by the Applicants, and claim 1 was amended to disclose that the catalyst is a cationic exchange resin. The WO '593 publication does not disclose or suggest the use of cationic exchange resins. Therefore, the rejection under 103(a) has been withdrawn due to the claim amendments. However, upon further consideration, a new ground(s) of rejection is made in view of the amendments to claim 1 in the response filed on 4/7/09.

- 3) In the reply filed on 4/7/09, the Applicants presented data of 8 examples, which the Applicants claimed show unexpected advantages of the presently claimed invention over other catalysts, such as zeolites and activated clays. However, this data is not found to be persuasive in view of the rejection of claims 1 and 3 in view of the US 2,711,414 patent, and Chakrabarti et. al. *Reactive Polymers*, **20**, pp. 1-45, which will be discussed in the following new 103(a) rejection. Chakrabarti et. al. teaches that cationic exchange resins are effectively used to improve product purity and yield with reduced costs over other catalysts. Therefore, the improved yields of 2-acylthiophene with the use of the cationic exchange resins over activated clays and zeolite, as stated by the Applicants, do not constitute unexpected advantages. Chakrabarti et. al. teaches that cationic resins often improve product yield and purity when used in organic reactions over other catalysts. As such, a showing of improved reaction yields with the use of cationic exchange resins in comparison to the activated clay catalysts and zeolite is not found unexpected or surprising, as it has

been known in the art that the use of such resins often lead to improved product yields.

- 4) The reply filed by the Applicant on 4/7/09, it was brought to the examiner's attention that US 2,458,512 patent of Hartough et. al. was listed as a reference on the Form-892 of the Office Action dated 1/7/09. However, the US '512 patent was not used as a prior art reference in the body of rejection for claims 1-3. The examiner recognizes that the reference was listed in error, and was not used for the rejection of claims 1-3 in the Office Action dated on 1/7/09.
- 5) The following new grounds of rejections was necessitated by the amendments to claims 1 and 3 and cancellation of claim 2 in the Applicant's reply to the first office action filed on 4/7/09.

***Claim Rejections-35 USC § 103***

- 6) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

- 7) The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:
1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
- 8) Claims 1 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2,711,414 patent, in view of Chakrabarti et. al. *Reactive Polymers*, **20**, pp. 1-45.
- 9) The US '414 patent discloses the use of cationic exchange materials for producing 2-acylthiophene in the presence of acetic anhydride (column 2, lines 12-44), in which the reacting compounds are used as self solvents (column 3, lines 27-36). The cationic exchange sulfonated copolymers of styrene, vinylbenzene, and ethylvinyl benzene taught are resins (column 2, lines 12-44). The US '414 patent teaches that the reaction temperature is between 75-125 °C (column 3, lines 27-32). The US '414 patent does not explicitly state that the reaction temperature is less than 75 °C.

Chakrabarti et. al. teaches that cationic exchange resins are effective at replacing traditional mineral acids and bases in organic reactions, as reactions rates are often higher and lower reaction temperatures are necessary (p. 2, column 1, and first sentence of column 2). Chakrabarti et. al. also teaches that the use of cationic exchange resins solves problems often encountered with traditional catalysts such as

waste disposal; resins can often be repeatedly used for reactions effectively, thereby lowering the cost associated with replacing catalysts (p. 6, right column, first paragraph). Furthermore, Chakrabarti et. al. teaches that product purity and yield are often improved when the catalysts employed are cationic exchange resins (p. 6, right column, first paragraph). While the US '414 patent teaches that the acylation occurs at temperatures 75-125 °C, it is taught that the compounds themselves can serve as the reaction solvents. Thiophene has a boiling point of 84 °C, and therefore the acylation reaction could reasonably be conducted at this temperature. Additionally, it would be obvious for one of ordinary skill in the art to optimize reaction conditions, such as determining specific cationic resins to be used and reaction pressure ranges, that would lead to increased yields of 2-acylthiophene at lower reaction temperatures, such as less than 75 °C, as it is known in the art that lower reaction temperatures result in less decomposition of products, thereby increasing purity. Additionally, the use of cationic exchange resins in the acylation of thiophene would add further benefits of increased yield and purity, and use lower reaction temperatures, as taught by Chakrabarti et. al. Therefore, it would have been prima facie obvious to one of ordinary skill in the art at the time the invention was made to use cationic exchange resins as catalysts for the preparation of 2-acylthiophene, as the US '414 patent teaches that thiophene can be effectively acylated without solvent within temperature ranges of 75-125 °C with cationic exchange resins, and Chakrabarti et. al. teaches that cationic exchange resins often result in improved purity, reaction yields, and lower reaction temperatures when used. Furthermore, it would have been obvious for one of ordinary skill to perform the



acylation of thiophene with cationic exchange resins at a temperature of less than 75 °C, as lower reaction temperatures result in less decomposition of the desired product, which reduces or eliminates the need for additional purification of the product. When the conditions of a claim have been previously established by the prior art, it is considered routine for one of ordinary skill in the art to optimize or determine the workable conditions, such as temperature, *In re Aller*, 220 F.2d 454, 105 USPQ 233 (CCPA 1955).

10) Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SARAH PIHONAK whose telephone number is (571)270-7710. The examiner can normally be reached on Monday-Friday 7:00 AM - 5:30 PM EST, with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sreeni Padmanabhan can be reached on (571)272-0629. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

S.P.

/SREENI PADMANABHAN/

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Supervisory Patent Examiner, Art Unit 1617